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RESEARCH

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Variation of the double product in patients after acute myocardial infarction submitted to aspersion bath

Variação do duplo-produto em pacientes pós-infarto agudo do miocárdio submetidos ao banho de aspersão

Variación de doble producto en pacientes después de un infarto de miocardio agudo presentó rociar baño

Samara Oliveira Moreira;[1] *Allan Peixoto de Assis;*[2] *Victor Hugo Souza Alves Vieira;*[3] *Paulo Sérgio Marcellini;*[4] *Renata Flávia Abreu e Silva*[5]

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ABSTRACT

Objective: This study aims to measure the double product variation in patients with acute myocardial infarction submitted to an aspersion bath. **Methods**: This is an observational study, performed at the Coronary Unit of a referral cardiology hospital located in *Rio de Janeiro* city, *Rio de Janeiro* State, Brazil. Data collection was carried out by sampling aspersion baths of adult patients of both genres with medical diagnosis of acute myocardial infarction either with or without elevation of the ST segment, and submitted to aspersion bath. **Results**: The results showed an increase in the average value of the double product in all patients, but without statistical significance. **Conclusion**: The aspersion bath in the study sample is a safe practice.
Keywords: Aspersion bath, nursing, myocardial infarction, cardiovascular nursing.

RESUMO

Objetivo: Mensurar a variação do duplo-produto nos pacientes com infarto agudo do miocárdio submetidos ao banho de aspersão. **Métodos**: Pesquisa observacional realizada na Unidade Coronariana de um hospital de referência em cardiologia localizado na cidade do Rio de Janeiro. A amostragem deu-se por conveniência e teve como amostra os banhos de aspersão de pacientes adultos, ambos os sexos, com diagnóstico médico de infarto agudo do miocárdio com supradesnível ou sem supradesnível de segmento ST, e

1 Nursing Graduate by the *UFRJ*, MSc in Nursing by the *UFRJ*, Specialist's Degree in Intensive Care by the *Universidade do Estado do Rio de Janeiro (UERJ)*, Specialist's Degree in Medical and Surgical Clinics by the *UFRJ*, Coordinator of the Patient Safety Center at *IECAC*.

2 Nursing Graduate by the *Universidade Federal Fluminense*, MSc in Nursing by the *UFRJ*, PhD student enrolled in the *PPGEnfbio* at *UNIRIO*, Assistant Professor of Medical-Surgical Nursing at *UFRJ*.

3 Nursing Graduate by the *UFRJ*, MSc in Nursing by the *UFRJ*, Specialist's Degree in Intensive Care by the *UERJ*, Nursing Professional of the Center for Postoperative Intensive Care of Cardiac Surgery at *IECAC*.

4 Pharmacy Graduate by the *Universidade Estadual Paulista Júlio de Mesquita Filho*, MSc in Food and Nutrition by the *Universidade Estadual Paulista Júlio de Mesquita Filho*, PhD in Food and Nutrition by the *Universidade Estadual de Campinas*, Associate Professor (level II) of both the Biochemistry Department and the *PPGEnfbio* at UNIRIO.

5 Nursing Graduate by the *UERJ*, Specialist's Degree in Clinical and Surgical Cardiology by the *UNIRIO*, MSc in Nursing by the *UNIRIO*, PhD in Science by the *UNIRIO*, Adjunct Professor (level II) of the Medical-Surgical Nursing Department at *UNIRIO*.

que tivessem indicação de banho de aspersão, fornecida pelo médico e enfermeiro responsáveis. **Resultados**: Houve aumento do valor médio do duplo-produto em todos os pacientes acompanhados, porém sem significância estatística. **Conclusão**: A indicação do banho de aspersão nesta amostra foi segura.

Descritores: Banhos, Enfermagem, Infarto do miocárdio, Enfermagem cardiovascular.

RESUMEN

Objetivo: Medir la variación del doble producto en pacientes con infarto agudo de miocardio sometido a baño de aerosol. **Métodos**: Estudio observacional, realizado en la Unidad Coronaria de un hospital de referencia en cardiología ubicada en la ciudad de Río de Janeiro. El muestreo se da por conveniencia y era para probar los baños de aspersión pacientes adultos, de ambos sexos, con diagnóstico de IAM con elevación o sin elevación del segmento ST, y que había indicación de baño de aerosol proporcionada por el médico y la enfermera responsable. **Resultados**: No hubo aumento en el valor medio de la doble producto en todos los pacientes siguió, pero sin significación estadística. **Conclusión**: La indicación del baño de pulverización en esta muestra era seguro.

Descriptores: Baños, Enfermería, Infarto del miocardio, Enfermería cardiovascular.

INTRODUCTION

Acute Myocardial Infarction (AMI) represents one of the main complications of the Coronary Artery Disease (CAD) and currently occupies the highest level of mortality in Brazil and in the world, together with other chronic non-transmissible diseases.[1] Individuals affected by the CAD are highly exposed to this potential complication.

Until the 1970s, absolute rest was recommended to AMI patients for a period of 6 to 8 weeks after the event, which is an estimated time necessary for the healing of the necrotizing myocardial area and the recovery of the ischemic tissue margin without risks.[2]

Based on this recommendation, nursing care basically focused on restricting self-care activities of CAD patients who had AMI, performing the bed bath and absolute rest as interventions, even outside the acute phase.[3] However, such a posture can be considered inadequate due to the deleterious effects of prolonged rest, such as predisposition to pulmonary thromboembolism, reduction of blood volume, reduction of cardiac output, reduction of muscle mass, low self-esteem, anxiety, increase of the number of complications, and increase of the hospitalization time and costs.[4]

The change of the behavior regarding this treatment system began mainly with the advent of the Cardiac Rehabilitation (CR), which was defined by the World Health Organization as the set of activities that can guarantee physical, psychological, and social improvements to CAD patients, providing, through self-care, quality of life.[2]

The CR programs advocate the administration of light periods of activities for the CAD patient during his hospitalization at the Coronary Unit (CU), after a clinical stabilization and/or coronary intervention. This is corroborated by the Cardiopulmonary Rehabilitation Directive[4] when it states that Phase 1 of the CR program corresponds to the hospitalization time. At this stage, passive exercises and minimal self-care activities, such as walking and assisted or independent toilet hygiene, can be performed according to the patient's response. It is observed that the resumption of the minimal activities, still in the CU, can increase the capacity of the cardiovascular function, reducing the negative effects of prolonged rest, facilitating the control of the psychological alterations and reducing the hospitalization time.[5]

It has been observed an evolution of the knowledge in nursing applied to cardiology and cardiac rehabilitation, when greater attention is noticed to the issues that involve the promotion of the patient's independence. In this way, it is possible to respect more their individualities and to enable early resumptions of self-care activities, increasingly rejecting the immutable idea of absolute rest and the requirement of, for example, performing the patient's bed bath.[6] The nurses' daily practice in CUs shows that many of the CAD patients who had AMI are able to perform their own hygiene in the shower with or without direct help. However, the absence of a systematic measurement of the degree of cardiac effort generated by the activity, therefore, hinders the evaluation of its cardiovascular safety.

As observed in a recent review,[7] there are few studies that seek to investigate the hemodynamic effects related to bathing, whether the bed or aspersion types. Likewise, there are huge gaps in the classification of clinical indicators that support the nurses' decision about which bath modality becomes safer in the context of the treatment of CAD patients.

It is a consensus in the studies that fatigue is the main subjective response observed, and the heart rate (HR), blood pressure (BP) and oxygen consumption (VO_2) increase from the baseline value when performing the bed or aspersion bath.[5,7-8] In a study[7] with CAD patients, the increase of such parameters was shown to be more related to aspersion baths, especially if the patient is in the supine position.

The predominant use of the HR and BP as cardiovascular response variables to be measured during bathing has been observed in the studies. The strategy of measuring them in isolation during physical activity in patients after an AMI is considered unsafe in the evaluation of cardiovascular responses. However, joint observation, through the calculation of the Double Product (DP), can be used as a safe parameter for the prescription and monitoring of this procedure.[8-9]

The DP is defined as a product between the Heart Rate and the Systolic Blood Pressure (HR X SBP). This index showed a strong correlation (r=0.88) with myocardial oxygen consumption, being the best indirect predictor of the cardiovascular effort.[8-10] From the intervention point of view, the DP is still considered the best noninvasive index for the evaluation of the myocardial work, both at rest and during the effort. Thus, it would be convenient to use this parameter as a reference when prescribing a physical activity with safety, as it allows to verify its effect on the cardiovascular system.[9] The DP tends to increase during physical activities, but its behavior depends on the type, intensity, and duration of the exercise, and the environmental conditions in which the intervention was performed.[11]

Regarding to the rest period, DP values tend to have lower values in resisted exercises and higher values–up to five times–in aerobic exercises.[9] High values of DP during an exercise are synonyms of the increase in the HR, Systolic Volume, Cardiac Output, and, in some cases, in the systemic vascular resistance.[10-12] Normal DP values range from 6,000 bpm.mmHg at rest to 40,000 bpm.mmHg in exhaustive exercises, setting the unbalance between the supply and consumption of myocardial oxygen when it exceeds 30,000 bpm.mmHg.[13] Therefore, the patient is usually restricted to the bed during hospitalization in the CU, being understood as a way to minimize the risk of increasing the DP and, consequently, possible damages.

Considering that the prescription of the aspersion bath by the nurse needs to be monitored the physiological response to this effort, it is worth observing the parameters that help in the evaluation of possible benefits of this intervention.

However, due to the lack of a systematic criteria for assessing the degree of the cardiac effort related to the aspersion bath, the following hypothesis was defined for the present study: the DP values increase after the aspersion bath in AMI patients. Therefore, the objective of this study has been to measure the DP variation in AMI patients submitted to aspersion baths.

METHODS

This is an observational study, with a quantitative approach, performed in a CU of a federal hospital, which is a national reference in cardiology, located in the city of *Rio de Janeiro*, *Rio de Janeiro* State, Brazil. The present study was inserted in the Brazil Platform and approved under the Legal Opinions No. 600277 and No. 333662 of the Committees of Ethics in Research of the proposing and co-participating institutions, respectively.

The sampling was non-probabilistic and had the aspersion baths as sample. The inclusion criteria were: adult patients, both genres, with medical diagnosis of AMI with elevation or no ST elevation. After the accepted invitation, the patients signed the Free and Informed Consent and had their bath accompanied by a nurse, who also performed the data collection.

The following variables were collected: sex, HR and BP before and after bathing, duration of bathing, number of post-event days, type of AMI, ventricular function at the echocardiogram, temperature of the water used in the bath and use of support (use of chair or foot bath). The HR and SBP data were later used to calculate the DP.

Data were collected by two nurses on alternate days and before and after five minutes of bathing, this time being based on a study[14] that defends this period as necessary for the stabilization of hemodynamic values after the alternation of body positions.

An aneroid sphygmomanometer certified by the *Instituto de Pesos e Medidas* (IPEM) [Institute of Weights and Measurements] and by the Clinical Engineering of the institution was used to measure BP values in patients lying down by the auscultatory method both during the pre-bath and post-bath periods. HR values were obtained through cardiac auscultation in apical focus for one minute by means of a stethoscope, also certified by the aforementioned service.

The data collected were treated in Microsoft Excel 2010® and R 3.1.1*, being demonstrated by descriptive statistics, with average, median and standard deviation. The normality of the sample was evaluated by the Shapiro-Wilk test. For the analysis of the pre-bath and post-bath periods, the Student's t-test was used for paired groups, adopting statistical significance with p-value <0.05.

RESULTS AND DISCUSSION

The study sample consisted of 52 aspersion baths followed during the nursing care given to 26 patients whose data are described in Table 1.

Table 1 - Distribution of the data of AMI patients

Sample Features	%
Genre	
Male	62
Female	48
AMI Classification	
ST segment elevation	54
No ST segment elevation	46
Left Ventricular Function	
Normal	8
Mild dysfunction	28
Mild-moderate dysfunction	11
Moderate dysfunction	11
Moderate-severe dysfunction	4
No echocardiogram	38

Source: Data collected.
Legend: AMI - acute myocardial infarction.

The majority of the patients were men (62%), AMI patients with ST segment elevation (54%) and a mean of 5.5 days of hospitalization after the ischemic event. At the time of data collection, the echocardiogram report was not available in 38% of the patients who participated in the study, but 16 patients showed a degree of left ventricular dysfunction classified as mild (28%), mild-moderate (12%) and moderate (12%). None of the patients presented severe left ventricular dysfunction in their echocardiograms. Regarding the water temperature during the bathing, 92% of the patients were submitted to aspersion bath with warm water, mostly in a standing position (58%) with duration of approximately 20 minutes (48%).

It should be noted that, regarding the pharmacological control of the DP, all patients were using antihypertensive drugs, including beta-blockers, Angiotensin-converting enzyme (ACE) inhibitors, Angiotensin receptor blockers and/or calcium channel blockers.

Table 2 shows the pattern observed in the aspersion baths:

Table 2 - Distribution of the data referring to the aspersion baths

Bath features	%
Water temperature	
Warm	92
Cold	8
Bath position	
Standing	58
Sitting	42
Bath duration	
10 minutes	15
15 minutes	37
20 minutes	48

Source: Data collected.

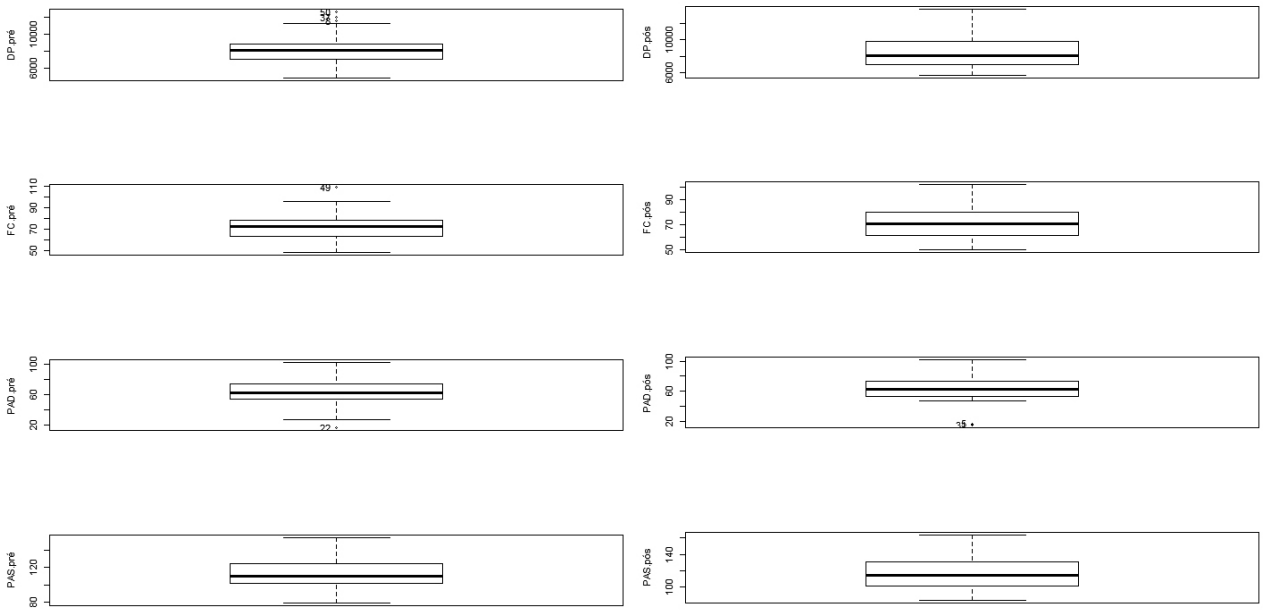
Regarding the water temperature during the bath, 92% of the patients were submitted to the aspersion bath with warm water, mostly in a standing position (58%) with duration of approximately 20 minutes (48%). No intercurrences were observed during the bath monitoring.

Table 3 - Distribution of the monitored hemodynamic variables during the aspersion bath, the pre-bath, and the post-bath periods

Hemodynamic Variables	Average (DP)	Median
Heart Rate		
Pre-bath	72,25 (12,42)	72,5
Post-bath	72,59 (12,54)	71
SBP		
Pre-bath	113,01 (17,25)	110,5
Post-bath	116,61 (17,89)	114,5
Diastolic Blood Pressure (DBP)		
Pre-bath	63,88 (17,45)	61,5
Post-bath	63,30 (16,25)	63
DP		
Pre-bath	8158,15 (1814)	8157.5
Post-bath	8433.135 (1848.397)	8068.5

Source: Data collected.
Legend: SBP - systolic blood pressure; SD - standard deviation.

Figure 1 - Distribution of the variables monitored during and after the spray bath



When correlating the hemodynamic variables collected and the calculated DP, it can be observed in Table 3 that there was no significant difference in its variation when comparing the measured parameters before and after the bath.

Table 4 - Correlation between the collected hemodynamic variables and the calculated DP before and after the aspersion bath

Variable	t-test	p-value
HR	0.1305	0,8967
SBP	-0.9737	0,3348
DPB	0.1935	0,8473
DP	-0.6736	0.5036

Source: Data collected.
Legend: HR - heart rate; SBP - systolic blood pressure; BPD - diastolic blood pressure; DP - double product.

The results of the study showed that there was an increase in the average values of HR, SBP and DP of patients after an AMI who had an aspersion bath, but this variation was considered statistically non-significant (p>0.05), which disagrees with the results of a study with 30 low-risk CAD patients.[15-16]

Regarding the high average DP values after the aspersion bath, it is observed that it did not reach levels above 30,000 bpm.mmHg, assuming that the supply-consumption ratio of myocardial oxygen remained stable during the aspersion baths.

The increase in the DP values of all study patients, as well as the HR and SBP values after the bath, shows an already expected behavior of these variables in terms of acute cardiovascular responses from physical exercises, with physiological relation with the release of system Sympathetic Nervous System mediators and the increased metabolic demand during an activity.[17]

In a Brazilian study that attempted to compare levels of anxiety with patients after an AMI Killip 1 and 2, between the aspersion and bed baths, there were also safe variations of BP and HR values after both bathing modalities regardless of the relation with the anxiety value, thus generating a safe variation in DP.[6]

It is noteworthy that all the patients in this study had an aspersion bath prescription by a nurse or physician, which clearly may have selected the sample containing patients with lower risks of clinical instability during the aspersion bath. This obviously hinders the extrapolation of the data to other scenarios and other populations outside the profile studied.

One of the possible hypotheses for the preservation of DP at safe levels, as well as other cardiovascular responses evaluated after the aspersion bath, may be based on the fact that patients already have pharmacologically controlled DP values, which makes it difficult to oscillate during light exercises such as the aspersion bath and other self-care activities. This differs from studies that measure DP in patients submitted to strength exercises, with lower cardiovascular risk and outside the hospital context.[17-18]

The main contribution of this research lies in the fact that the professionals responsible for the prescription of the bath in AMI patients in the acute phase can use the DP as a criterion for the evaluation of myocardial oxygen consumption in the pre- and post-bath periods. And that the aspersion bath prescription for the study patients did not significantly cause variations in PD values, presuming that this activity did not generate deleterious cardiac effort to the myocardium.

It is important to emphasize that during the data collection the age parameter as well as the occasional use of cardiovascular drugs were not prioritized, being of fundamental importance in later studies the use of this parameter to group and make possible a better visualization of the sample of the patients studied.

Another point to be considered was the absence of the echocardiogram report in 38% of the sample, which may have omitted functional ventricular information important for the characterization of the patients studied.

It is necessary that other studies may contribute to the theme by expanding the profile of the study patients, exploring the subjective and objective criteria of the clinical evaluation for aspersion bathing and mainly using other variables with a more sensitive spectrum of cardiovascular safety evaluation in AMI patients submitted to aspersion bath.

CONCLUSION

CAD patients after an AMI do not appear to have a relevant variation of DP when submitted to aspersion bath when comparing this value before and after the procedure. It can then be considered that, in this specific population, the aspersion bath was a safe procedure and it did not cause harm to any patient.

Prospective studies with larger samples are encouraged in order to confirm the possibility of using the DP value for the aspersion bath prescription in order to stimulate the patient to walk and prepare him for the discharge from the CU.

This study presents as a main limiting point of research the sample size in relation to the studied phenomenon. A larger sample would have a chance to explore the primary endpoint more significantly.

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Corresponding Author:
Samara Oliveira Moreira
Rua David Campista, 326, 9º andar
Centro de Estudos, Humaitá, Rio de Janeiro
ZIP CODE: 22.261-010
E-mail: <sassa.ufrj@bol.com.br>